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Water Quality Report

South Fork Tributary Habitat Enhancement Project

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Siskiyou County, California

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Water Quality Report

Introduction

The purpose of this report is to:

1) Analyze and describe the potential risks to water quality and riparian resources posed by this project,
2) Describe the potential benefits of the project to water resources, and
3) Ensure this project will comply with all regulations, laws, and policies related to water resources.

Methodology

Analysis Indicators

The probability of direct and indirect effects of each project alternative (Action or No Action) will be assessed qualitatively. In addition, three analysis indicators will be used to assess the relative risk to water quality and riparian resources:

1) Potential of increased temperature loading to the Salmon River.
2) Likelihood of increased sediment loading to the Salmon River.
3) Change in the number of large wood pieces within the bankful channel.

Measures

Measures are used to facilitate the comparison of alternatives. The likelihood of adverse effects to water quality will be assessed quantitatively (by proxy) for temperature and sediment:

1) An increase in stream temperature may occur. The potential for increased stream temperature is approximated by the length (linear feet) of stream channel disturbed by placing the structures and placed into context at the watershed scale.
2) A short-term increase in sediment may occur. The potential for increasing sedimentation is approximated by the area (acres) of soil disturbance at the project site, including temporary access roads and storage areas. The risk likelihood for sediment is based on the Equivalent Roaded Area model (ERA; See Affected Environment). The ERA model translates management actions to acres of impact and developed thresholds of concern (TOC) for impacts at the watershed scale. 1,343 acres of road would need to be built in order to cause the 7th field watersheds to exceed the TOC for ERA. An exceedance of the TOC does not necessarily mean that adverse effects will occur, it's just an indication that the risk (likelihood) of adverse effects are high. The range of impacts below is based on the levels of impact in relation to the TOC and in this case, can put potential sediment loading into perspective.

ERA Acres	Percent of 7th Field Watershed Threshold of Concern	Likelihood of increased sediment
13.4	1	Low likelihood

134	10	Moderate likelihood
1,343	100	High likelihood

3) The change in the number of large wood pieces to the bankful channel will be quantified by calculating the total number of pieces added to the streams within the project area. Additionally, the associated changes to channel function and morphology will be addressed through a qualitative discussion.

Spatial and Temporal Bounding of Analysis Area

The spatial bound for this analysis is the Knownothing Creek (180102100107) and Methodist Creek (180102100108) 7th field hydrologic units. This boundary is appropriate for assessing the project impacts as they might be experienced by an aquatic organism at the confluence with the Salmon River. The contributing drainage area to Knownothing Creek is 22.8 mi2 (14,561 ac.) and the contributing drainage area to Methodist Creek is 28.3 mi2 (18,106 ac.).

The short-term temporal bound for the analysis is 2 years and is based on the assumption that an overbank flow event has a high likelihood of occurring within 2 years of project implementation. Sediment scour and mobilization (with direct effects to water quality) are expected to manifest by an overbank flow event.

The long-term temporal bound for the project is 10 years because it is expected that any potential reductions to stream shade (and indirect and cumulative adverse effects to water temperature) from project activities will recover within 10 years, if not more quickly. This timeframe assumes that reduced shade is primarily due to the disturbance to Himalayan blackberry (*Rubus armeniacus*), poison oak (*Toxicodendron diversilobum*), and the removal of white alder (*Alnus rhombifolia*). It is expected that blackberry and poison oak will recover and completely shade the reach within a few years of disturbance; no more than 10 years.

Affected Environment

The project encompasses 20 sites in Knownothing and Methodist Creeks, intermittently extending over 3.2 miles of stream (1.4 miles and 1.7 miles respectively), within the South Fork Salmon River watershed. The entire project area is located on Klamath National Forest lands. Knownothing Creek is about 23 miles upriver of the Salmon River/Klamath River confluence and Methodist Creek is about 25 miles from the confluence.

The upper and middle watershed topography in Knownothing and Methodist Creeks is located in steep, mountainous terrain with hillslope gradients frequently exceeding 70% along inner gorges, headwalls, and upper hillslope positions. The lower reaches of the watersheds (where the proposed project occurs) flow over a low gradient, broad alluvial fan/river terrace complex that is naturally prone to channel deposition and shifting alignments; however, the floodplain is channelized. As recently as 1950, Knownothing and Methodist Creeks flowed across the entire floodplain, utilizing the potential channel capacity and discrete side channels. Therefore, there is a possibility that during an extreme storm event the active streams could utilize their floodplains and develop a more complex channel alignment.

At various locations in the watersheds, ancient terrace deposits as well as older erosion surfaces are preserved. The older river terraces occur up to several hundred feet upslope of the present channel, more recent terrace deposits occur near the active channel of the stream and consist of sand, gravel, and boulder deposits (de la Fuente and Hassig, 1994). Both creeks were disturbed by historic placer mining, which has

left behind a mix of natural and man-made landforms including placer tailing piles strewn throughout the natural floodplain terraces adjacent to the active channel(s). Additionally, the streams have an abundance of boulders not suitable for spawning; most of the fine sediment and cobble have been transported out of the stream into the South Fork Salmon River.

Knownothing and Methodist Creeks have degraded habitat complexity as a result of historic unrestricted stream clearing, logging, and mining. Logging that occurred from the 1950s - 1980s resulted in the removal of most of the large conifers from the creeks. Large woody debris was also pulled out of these tributaries during the 1980s. Taken together, these historic and more recent efforts have resulted in a broad-scale simplification of channel complexity and a corresponding reduction of suitable habitat for all life stages of salmonids. The landscape at the watershed-scale shows that recovery has been sometimes very slow due to local conditions and nutrient deficient soils.

An instream structure assessment completed by the SRRC in Knownothing and Methodist Creeks in 2014 showed an overall lack of large diameter wood instream structures and the resulting habitat complexity required for successful spawning and rearing for coho salmon and other salmonids (SRRC unpub. data). The assessment found that within the bankful channel of Knownothing Creek there were 10 dead and down large wood pieces within the project area. In Methodist Creek, there were 17 large wood pieces within the project area. This value has likely changed since the assessment as large wood recruitment and loss out of the system changes on an annual basis. However, the streams lack live and standing dead trees along the banks which could be mobilized and recruited during high flows and therefore the number of large pieces is likely similar to the 2014 assessment.

The project comprises 1.35 acres, primarily in riparian areas, though the footprints of individual structures are very small. Both creeks are deficient in complex channel habitat associated with naturally occurring large diameter wood accumulations, which results in high velocity, shallow, entrenched, channelized streams, which are relatively stable in their current flow paths. The creeks flush water, sediment, organic material, and racking wood too quickly through the system, resulting in limited connection of flows within the floodplain. This lack of floodplain inundation and hyporheic flow limits shade creating riparian vegetation, and exacerbates already high stream temperatures (NCRWQCB 2005), resulting from logging in riparian reserves and high road densities within the watersheds. Simulations developed for the 2005 Salmon River Total Maximum Daily Load (TMDL) for Temperature and Implementation Plan show that an increase in effective shade from current to adjusted potential shade condition results in a decrease in stream temperatures and that increased shade has a greater effect on stream temperatures of tributary segments than of mainstem segments. Knownothing and Methodist Creeks were modeled in that simulation and showed that restoring the streams to potential effective shade conditions could lower stream temperatures by as much as 0.6°C to 0.9°C, respectively (NCRWQCB 2005). Additionally, the lack of wood structures, results in a lack of cool water pools, cover and food source features for juvenile salmonids, and the loss of spawning size gravel as it's flushed out of the system.

Mean annual precipitation averages 45.3 in. and ranges anywhere from 41 in. to 55 in. annually (NCDC COOP Station 043151). Elevations range from 1,340 ft at the mouth to 6,650 ft at the ridgeline in the Knownothing drainage and elevations range from 1,570 ft at the mouth to 6,620 ft at the ridgeline in the Methodist drainage. The creeks are not gaged, therefore peak flows have been estimated indirectly, using USGS' California StreamStats model (Ries et al., 2004).

Table 1. Estimated peak flows in Knownothing and Methodist Creeks.

Stream	Return Period for Peak Flow (year)

	2	**5**	**10**	**25**	**50**	**100**	**500**
Knownothing Creek estimated peak flow (cfs)	1,890	3,290	4,280	5,550	6,500	7,460	9,590
Methodist Creek estimated peak flow (cfs)	960	1,740	2,300	3,020	3,570	4,130	5,360

The Salmon River hydrologic area (as defined by the North Coast Regional Water Quality Control Board) is registered on the Clean Water Act 303(d) list as impaired for temperature, as part of the Klamath Hydrologic Unit listing (NCRWQCB, 2005).

As part of the listing, the 2005 Salmon River TMDL for Temperature and Implementation Plan adopted a temperature "loading capacity" limit for the river (NCRWQCB, 2005). The loading capacity provides a reference for calculating the amount of temperature load reduction needed to bring a water body into compliance with standards. In order to interpret this load capacity, water quality temperature objectives pertaining to the life stages of anadromous salmonids were identified. A 5°F rise in the temperature of cold water above natural receiving water temperatures is the effects threshold used to interpret the narrative water quality objectives for temperature from the Plan (NCRWQCB, 2005). This threshold applies to the confluence of the South Fork Salmon River and Knownothing and Methodist Creeks, which are within the project area.

Klamath NF conducted a stream temperature study during low flow conditions in 2010 and 2011. In addition to recording stream temperature within 87 watersheds, air temperature, and stream shade data were also collected and analyzed. The final report (Laurie, 2012) reveals a significant correlation between the watershed average of stream shade, mean July air temperature, drainage area, and elevation as predictor variables for the maximum weekly maximum temperature (MWMT). Most importantly, the stream shade data showed 53% of the measured watersheds had human-caused shade loss, of which, 72% (33 watersheds) were not meeting the Basin Plan standard for temperature. Knownothing and Methodist Creeks were found to have altered shade and MWMTs greater than 16°C, the temperature threshold for core juvenile salmonid rearing. Interestingly, the study found that 85% of the of all the assessed streams on the Forest are warmer than the 16°C standard, including 15 out of the 20 reference, or unmanaged streams, suggesting that the natural temperatures of many streams on the Klamath NF are warmer than the threshold standards used to assess them.

A recent study looking at the threshold of concern associated with desired conditions for in-stream sediment in streams within the Klamath National Forest included surveys of Knownothing and Methodist Creeks (USFS 2016). The study found that Knownothing Creek and Methodist Creek had all classes of sediment indicators at less than reference conditions, with the exception of Methodist Creek which exceeded the subsurface sediment indicator (<6.38mm) reference condition in 2014. Therefore, Knownothing Creek is attaining desired conditions for all classes of sediment, while Methodist Creek is failing to meet desired conditions for the subsurface sediment indicator. However, in Methodist Creek there was no significant change between the first and second year sampling periods. Pre-implementation monitoring will increase understanding of natural sediment conditions in each creek.

More sophisticated analyses of historic disturbances are done by the Klamath NF via models. A set of three standardized Cumulative Watershed Effects (CWE) models are used to assess the influences of past,

present, and reasonably foreseeable activities and wildfires on water quality: Equivalent Roaded Area (ERA), Universal Soil Loss Equation (USLE), and mass-wasting. They compare computed disturbance levels to established thresholds of concern (TOC). TOCs are points beyond which there is increasing susceptibility for significant adverse cumulative effects within a watershed (Bell, 2012).

The 7th field watershed areas and perennial stream lengths, along with these CWE model results are used within this report to compare estimated current conditions for project. The results, in the form of risk ratios (computed disturbance/TOC), are displayed in Table 2. For full results see Appendix A.

Table 2. Watershed existing conditions as assessed by the three CWE models.

Project Site	7th Field Watershed	7th Field Area (sq. mi.)	7th Field Length (ft)	ERA	USLE	Mass-Wasting
Knownothing Creek	Lower Knownothing Creek-South Fork Salmon River	2.6	13,569	0.31	0.33	0.5
Methodist Creek	Methodist Creek-South Fork Salmon River	12.7	43,347	0.25	0.29	0.34

Results displayed in **Error! Reference source not found.** indicate that the bounding 7th field watersheds for Knownothing and Methodist Creeks have computed disturbance levels well below the TOC of 1.0 for the ERA, USLE and mass-wasting models.

Within the 7th field watershed, current activity in addition to this project include 19 active mining claims, the Hotelling Gulch Fish Passage and Stream Restoration Project, and the Knownothing Fuels Reduction Project. Eighteen of the mining claims are placer claims and do not have Plans of Operations in place. Therefore, the mining is limited to gold panning, small test hole excavation for prospecting, and small scale processing of the mined material. The Discovery Day Mine is a hard rock mine, which will likely have a Plan of Operations, including an Environmental Assessment, in the near future. The Plan of Operations will include design criteria to avoid altering/degrading potential coho salmon habitat in Knownothing Creek. The Hotelling Gulch Fish Passage and Stream Restoration Project plans to remove a fish barrier and improve natural stream function in Hotelling Gulch. The Knownothing Fuels Reduction Project began in 2013 and is on-going. It includes the removal of ladder fuels, brush re-growth, and hazardous snags through cutting, handpiling, and burning piles.

Environmental Consequences

Alternative 1 – No Action

Direct Effects and Indirect Effects

If the No Action alternative is selected, there will be no soil or vegetation disturbance by this project within the 7th field analysis watersheds (Table 3). However, currently, both Knownothing and Methodist creeks have degraded fish habitat, riparian habitat, and water quality, and are not meeting Forest Plan Aquatic Conservation Strategy Objectives.

The No Action Alternative would continue to directly and adversely affect water quality by maintaining stream flow in simplified channel alignments, greatly lacking in large wood instream structures. Within

the bankful channel, the total number of dead and down large wood pieces will remain at levels that limit the natural function of the stream system (10 pieces in Knownothing Creek and 17 pieces in Methodist Creek). The simplified channels of Knownothing and Methodist Creeks will continue to have high velocity flushing events during peak flows. Without the large wood structures to rack debris and slow stream flows, the channels will maintain shallow flows; poorly sorted gravels; and lack cool pools with cover and food sources for juvenile salmonids. The lack of connection to the floodplain and limited hyporheic flow will also result in limited riparian shading, which raises water temperatures. The simplified channels will continue to lose spawning gravels to high velocity flow events, as sediment and large woody debris are flushed into the South Fork Salmon River.

There are no beneficial direct or indirect effects from this alternative.

Table 3. Analysis Indicators and Measures of No Action Alternative

Analysis Indicator	Measure Value
Potential of increased temperature loading to the Salmon River.	0 linear feet of stream channel disturbed – No potential of increased temperature loading to Salmon River
Likelihood of increased sediment loading to the Salmon River.	0 ERA acres – Low likelihood of increased sediment to Salmon River
Large Wood pieces within bankful channel of project area	27 pieces

The CWE models indicate the current risk ratio for the ERA, mass-wasting, and USLE are below the TOC (Table 2). The CWE models were not used to analyze the effects of project alternatives because the proposed action would not produce a disturbance large enough to be detected by the models. CWE models were used to place the project within the context of the current conditions within the 7th field watershed.

Cumulative Effects

The effects of mining activity within the watershed is minimal and limited to small surface disturbances. If the Discovery Day hard rock mine implements a Plan of Operations it would include management to avoid altering or degrading coho salmon habitat, and therefore water quality, so there would be no cumulative impact to Knownothing Creek. The stream restoration and fuels reduction projects are localized and have a small project footprint relative to the 7th field watersheds. None of these activates is expected to affect instream flows, including stream temperature, sediment, channel stability, or groundwater systems within the project area or the 7th field watershed.

Therefore, the current condition of the channel in relation to the ongoing activities within the watershed will not combine to result in adverse cumulative effects.

Alternative 2 – Proposed Action

Direct Effects and Indirect Effects

By constructing 20 large diameter woody debris sites in Knownothing and Methodist Creeks, the pool forming structures will encourage scour, increasing pool depth. The pools will improve thermal refugia and slow stream velocity. The large wood structures will be built and anchored in compliance with Chapter VII of the California Department of Fish and Wildlife (CDFW) Habitat Restoration Manual

(Flosi et al., 2010) and through the guidance of the CDFW grant manager for this project. This will ensure the structures meet project goals and objectives, as well as remain stable in the dynamic environment of the Salmon River system. Within the bankful channel, the total number of dead and down large wood pieces be increased by 100 pieces in order to improve the natural function of the stream system (68 pieces in Knownothing Creek and 32 pieces in Methodist Creek). The proposed action will improve habitat complexity and rearing productivity for all life stages of salmonids, this project will:

- Increase over-summer rearing habitat through pool development,
- Increase over-winter rearing habitat by providing velocity refugia,
- Enhance/entrain spawning gravels,
- Provide for a wide range of habitat heterogeneity for juvenile and adult salmonids, and
- Increase stream flow residence time and improve surface water and groundwater interaction.

The enhanced channel complexity will increase pool and slow water habitat by creating roughness in the system, which will decrease stream velocity. Slowing stream velocity will improve subsurface groundwater retention within the floodplain, increasing the amount and residence time of hyporheic flow (groundwater/surface water interaction), which will enhance riparian vegetation and result in increased shade (Poole and Berman 2001; Sawyer and Cardenas 2012). This has a beneficial indirect effect on water temperature by maintaining hyporheic flow longer into the water year, improving cool water refugia conditions in-stream, and providing cool water inputs to the South Fork Salmon River during critical summer months for salmonid rearing, benefiting both anadromous fisheries recovery and TMDL implementation goals.

Since coho salmon spawn in December when flows are highest, suitable spawning habitat is typically limited in the main river channel with off-channel habitats and tributaries providing the most suitable habitat for spawning. The large woody debris will create slow water rearing habitat and refugia from high flows. Additionally, the structures will provide cover and a food source for juvenile salmonids.

Increased channel complexity and reduced stream velocity will result in better sorted gravels. In particular, the increase in pool and slow water habitat will result in accumulated spawning gravels as they collect in pool tail-outs and low gradient riffles. Pool forming structures will encourage scour, increasing pool depth. As the complexity of the stream increases, sediment will deposit intermittently throughout the creeks, rather than being transported continuously and depositing at the mouth or the South Fork Salmon.

Enhancing these streams will meet Forest Plan Aquatic Conservation Strategy Objectives by aiding the recovery of fish habitat, riparian habitat, and water quality (6-46). The cold water of the South Fork Salmon River is vital to providing summer rearing habitat for coho salmon. The lack of habitat complexity inherent to many Salmon River tributaries is currently limiting the potential for the recovery of the coho population in a watershed that has tremendous potential for providing a long-term stronghold (refugia) for salmonids. The proposed project will result in improved habitat complexity during all life stages of the salmonid life cycle through implementing a diverse range of constructed log features that will interact with these channels during a wide range of stream flows.

The streambanks will be minimally disturbed as a result of construction; the total soil disturbance for the project is approximately 0.30 acres and 450 linear feet along stream channels. However, such disturbance will occur within the annual floodplain; areas annually disturbed by high flows. The total disturbance from temporary access routes (15-foot width) is approximately 1,025 linear feet (0.35 acres) within riparian areas and 2,050 linear feet (0.70 acres) in upland areas. This equates to 3,075 linear feet total of

temporary access, which calculates to 2.8 ERA acres (using the KNF standard disturbance threshold calculation).

Within the short-term (2 years) timeframe, the proposed action has the potential to increase sediment loads within Knownothing and Methodist Creeks, as well as the South Fork Salmon River (Table 4). While sediment is a natural and necessary part of every fluvial system, it is physically and ecologically important to avoid contributing excess sediment by anthropogenic means. Where soil and vegetation are disturbed by construction activities (equipment access, storage areas and placement of large woody debris) water is more likely to erode and deliver sediment to the stream channels increasing turbidity, however the incremental area of ground disturbance for the project is less than 1.4 acres.

A conceptual model of turbidity occurs in two phases; a pulse of suspended sediment associated with construction activities and continued erosion of fine particles from disturbed banks until such time that vegetation stabilizes the soil (Sear et al. 1998). The initial suspended sediment release is expected to be short-term, with the amount of suspended sediment rapidly dropping to pre-construction levels both in time and space (Sear et al. 1998; Madej 2001; Brown 2002; Foltz and Yanosek 2005). Most erosion will occur in the first few high water events following channel work, with long-term stabilization occurring once vegetation re-established (Sear et al. 1998; Madej 2001).

These short-term impacts will be reduced by working during dry conditions and placing erosion controls prior to and during construction, including permanent soil stabilization immediately following construction.

Within the long-term (10 years), the proposed action has the potential to adversely affect stream temperature through a loss of shade from riparian vegetation where structure placement removes canopy cover (Table 4). However, the incremental area of riparian disturbance is less than 0.3 acres. The potential long-term impacts can be expected to last no more than 10 years, because riparian vegetation is expected to recover and fully shade the stream within a few years of disturbance. Tree removal for equipment access/operation will result in minimal canopy shade loss over the streams. In riparian areas, a total of 15 white alders will be removed; all less than 12-inches DBH. In upland areas, three oak trees and two Douglas fir trees will be also be removed; all less than 12-inches DBH.

Heavy equipment is expected to enter and/or cross the wetted channel of Knownothing and Methodist Creeks. Best Management Practices (BMPs) will be employed to prevent contamination from fuel and oil by heavy equipment.

Additionally, extensive before/after effectiveness monitoring and analysis will be conducted for this restoration project. This will allow us to gain valuable insight into how specific wood loading techniques and structural designs perform in the context of the South Fork Salmon River watershed. Lessons learned from this monitoring study will be broadly applicable to instream habitat restoration activities throughout Northern California and the Pacific Northwest.

Table 4. Analysis Indicators and Measures of the Proposed Action

Analysis Indicator	Measure Value
Potential of increased temperature loading to the Salmon River.	450 linear feet of stream channel disturbed – 0.8% of the total 7th Field stream length for the project. No

	potential of increased temperature loading to Salmon River
Likelihood of increased sediment loading to the Salmon River.	2.8 ERA acres of soil disturbance – Low likelihood of increased sediment to the Salmon River
Large Wood pieces within bankful channel of project area	127 pieces

Although temporarily increasing temperature and sediments loads in the short term is possible, the potential effects must be put into perspective. When one considers the area of disturbance in comparison to the 7th field watershed area, it is clear the overall potential effects on stream temperature and sediment regime should be very small (insignificant), if not imperceptible, within the short-term and absent during the long-term. The disturbance is expected to be about 1.4 acres total (Table 4); 0.8 acres in Knownothing Watershed (0.05% of the 7th field watershed) and 0.6 acres in Methodist Watershed (0.007% of the 7th field watershed).

CWE results displayed in Table 2 indicate that the three models, in relation to the bounding 7th field watershed, have computed disturbance levels well below the TOC. The modeled risk is low for ERA, mass-wasting, and USLE, therefore any additional impacts from this small project would not change the TOC. In addition, PDFs, BMPs, and natural vegetative regeneration will mitigate the acute sediment delivery. CWE models were not used to assess the effects of project alternatives because the project activities will not result in a disturbance large enough to be detected by the models. CWE models were used to place the project within the context of the current conditions within the 7th field watershed.

In addition to the small project scale, standard permit requirements, Project Design Features (PDFs), and Best Management Practices (BMPs, Appendix B of the EA) are integrated into the proposed action. Such water quality protections include:

- PDF WS-1 - Access routes will be stabilized, if necessary, immediately following implementation and completed by November 1st, or the first significant rainfall, whichever comes first. Implementation will begin after July 9th. Ground disturbing activities will also be restricted during periods of wet weather during the Normal Operating Season.
- PDF WS-2 - Mulch and/or seed areas disturbed by restoration activities where sufficient levels of soil cover are lacking.
- PDF WS-3 - Erosion control and other requirements to protect water quality are described in BMPs, (Appendix B). If "conditions arise or change in such a manner as to be considered deleterious to aquatic life, operations shall cease until corrective measures are taken" by CDFW.
- PDF WS-4 - The designated Project drafting site is within a Pacific salmonid-bearing stream reach. Therefore, *NOAA Fisheries Water Drafting Specifications* guidelines will be used. They include, but are not limited to, the following:
  1. When in habitat potentially occupied by Chinook and Coho salmon, intakes will be screened with 3/32-inch mesh for rounded or square openings, or 1/16-inch mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8-inch mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet/second.
     a. Use of a NOAA approved fish screen will ensure the above specifications are met.

2. Fish screen will be placed parallel to flow.
3. Pumping rate will not exceed 350 gallons-per-minute (gpm) or 10% of the flow of the anadromous stream drafted from.
4. Pumping will be terminated when tank is full.
5. For any water drafting that occurs in non-fish bearing waters, Forest Service BMP 2.5 defines restrictions. All water drafting will avoid having any effect on the amount of cold water in thermal refugia at creek mouths and seeps.

- Shrub, and tree removal to allow equipment access/operation will result in the least possible amount of canopy shade loss over the stream channels.
- All trees removed during project activities will be retained on-site for use as in habitat structures.
- Work will be conducted during low flow conditions, with the minimal equipment necessary to implement the project.
- All structure implementation and work along the stream channel will be completed by October 15th, avoiding winter weather working conditions.
- The worksites will not be dewatered, nor will sediment controls be used, because the disturbance to implement those mitigations would be greater than the work itself. Water quality will be monitored visually at the second pool tailout downstream of active construction. If turbidity occurs extending beyond the second pool tailout, construction will be stopped until it clears.
- No fueling/refueling of mechanical equipment will occur within 100 feet of any flowing watercourse or intermittent drainage, and contour berms will surround equipment refueling areas in order to prevent surface water contamination through runoff. If a spill occurs, it will be reported and cleaned-up in accordance with applicable State and Federal laws, rules, and regulations. Vegetable oil or other biodegradable hydraulic oil will be used wherever possible in order to lessen the environmental impact of a leak.
- Mechanized equipment will be inspected for oil, grease, fuel, and other leakage prior to crossing the channel. If necessary, it will be cleaned in a designated area with suitable absorbent material. Absorbent material will be disposed of in an appropriate manner
- During the initial crossing operation at a given site, absorbent booms will be placed downriver to capture any petroleum leaks. Booms will be removed from the river following the crossing, and properly cleaned or disposed, if contaminant leak is evident. After the initial crossing at a given site, if it is demonstrated that future crossings at the same site will pose a low risk, the boom may not be required.

Cumulative Effects

The effects of fuels reduction work, stream restoration, and mining within the watershed is minimal and limited to small surface disturbances in the watersheds. The fuels reduction work and mining is localized and has a small project footprint relative to the 7th field watersheds. If the Discovery Day hard rock mine implements a Plan of Operations it would include management to avoid altering or degrading coho salmon habitat, and therefore water quality, so there would be no cumulative impact to Knownothing Creek. These activates are not expected to affect instream flows, including stream temperature and sediment within the project area, Knownothing and Methodist Creeks, or the 7th field watersheds. The Hotelling Gulch Fish Passage and Stream Restoration Project aims to improve conditions for salmonid fisheries on the South Fork Salmon River. The project footprint is minimal, but does combine with this project to have an incremental benefit to water qaulity on the South Fork Salmon River.

Therefore, the addition of this project to the ongoing activities within the watershed (mining, fuels reduction, and stream restoration) will not combine to result in adverse cumulative effects. Therefore, restoration activities will not produce adverse cumulative effects to water quality due to the small size for the project and specified PDFs and BMPs which will mitigate potential impacts of the project.

Summary of Effects

The analysis indicators show the Proposed Action poses some small risk to water resources when compared with the No Action Alternative (Table 5). However, because the proposed action is small in scale, incorporates protections for water resources through careful planning, project design features and best management practices, direct and indirect adverse impacts to water resources are not expected. Should any occur, they would be short-lived and insignificant.

Within and beyond the long-term timeframe, the project is intended to have a beneficial indirect effect on water quality by increasing the quantity of cool water inputs at the confluence with the South Fork Salmon River and providing complex stream channel habitat to spawning and juvenile salmonids.

Table 5. Water Resources Analysis Indicators by Alternative

Analysis Indicator	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Potential of increased water temperature loading at the confluence of the project stream and the South Fork Salmon River.	0 linear feet	450 linear feet
Likelihood of increased sediment loading at the confluence of the project stream and the South Fork Salmon River.	0 ERA acres	Low likelihood of increased sediment to Salmon River. 2.8 ERA acres.
Large Wood pieces within bankful channel of project area	27 pieces	127 pieces

Compliance with Law, Regulation, Policy, and the Forest Plan

Compliance with the Klamath NF Land and Resource Management Plan and the Aquatic Conservation Strategy

The Klamath LRMP Record of Decision (ROD) is the guiding document for all Forest projects. The Klamath LRMP includes reference to the Aquatic Conservation Strategy (ACS), which incorporates specific standards and guidelines for riparian reserves set within the overarching Northwest Forest Plan (ROD to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl) (USDA Forest Service and USDI Bureau of Land Management 1994). All projects within Riparian Reserves on the Klamath National Forest must therefore be consistent with the objectives, standards, and guidelines of the ACS. The project is located in the Riparian Reserve Management Area (MA-10). Forest-wide standards and guidelines include direction to maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. These include, but are not exclusive to, standards and guidelines: 9-1, 9-4, MA10-13, MA10-17, MA10-18, MA10-19, MA10-20.

The South Fork Tributary Habitat Enhancement Project is consistent with the LRMP standards and guidelines, including the ACS objectives (for details please see the Forest Plan Consistency Checklist within the project record).

Compliance with the Clean Water Act
The Salmon River hydrologic area is listed on the Section 303(d) List for impairment or threat of impairment to water quality associated with temperature. The Salmon River Temperature Total Maximum Daily Load and Implementation Plan was prepared to reduce the temperature issues in the watershed over the long-term (NCRWQCB, 2005). By meeting the Total Maximum Daily Load the project will meet the Basin Plan objective for temperature. The Total Maximum Daily Load will be met through the Clean Water Act Section 401 permitting process as described below. By enhancing riparian vegetative shading and increasing hyporheic flow, this project will cool flows into the South Fork Salmon River, benefiting both anadromous fisheries recovery and TMDL implementation goals.

Compliance with the Wild and Scenic Rivers Act
The Salmon River was designated a Recreational and Scenic River within the National Wild & Scenic Rivers System in 1981. Designated Recreational Rivers are typically readily accessible by road or railroad, may have some development along their shorelines, and may have undergone some impoundment or diversion in the past. Designated Scenic Rivers are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. The South Fork Salmon River is located within the designated corridor. Project activities will not adversely impact the values for which the Salmon River was designated.

Permitting
All required permits have been granted for this project. The project is covered under the programmatic US Army Corps of Engineers Clean Water Act section 404 Regional General Permit 12, which includes Section 7 consultation for the ESA. The project has received Water Quality Certification (Clean Water Act section 401) from the State Water Resources Control Board. The project also has received a Section 1600 Streambed Alteration Agreement with California Department of Fish and Wildlife.

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Appendix A - Cumulative Watershed Effects models for the 7th field watersheds of Knownothing and Methodist Creeks

Results of 2017 KNF Cumulative Watershed Effects models for the 7th field watersheds of Knownothing and Methodist Creeks:

Drainage Code	Drainage Name	Total Current Soil Erosion Delivery (yd^3/year)	USLE Background	Total Current USLE Risk Ratio	Mass-Wasting Disturbance Background Sediment	Mass-Wasting Background	Mass-Wasting Risk Ratio	ERA TOC*	Watershed Size (acres)	Total ERA (Acres)	% ERA	ERA Risk Ratio
18010210010703	Lower Knownothing Creek	79.40	34.28	0.33	6588.15	3309.66	0.50	10%	1673	51	3.06	0.31
18010210010801	Methodist Creek	440.67	202.58	0.29	31149.01	18591.30	0.34	8%	8119	160	1.97	0.25